ANALYZING COMPANY SHARE-PRICE PERFORMANCES THROUGH A LENS OF STOCK-BASED COMPENSATION

by

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A THESIS

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This thesis examines the relationship between stock-based compensation (SBC) and company share price performance from 2010 to 2023. This thesis used a dataset of 52 publicly traded companies from the S&P 500, each of which was then sorted into one of four indices – each representing a quartile of SBC/EBITDA ratios. These indices were then compared relative to each other to gauge relative performance. Indices were made using both market-cap and equal weight methods, but ultimately the equal-weight index was chosen due to solely analyzing the effects of SBC on company performance. Additional adjustments were made for systemic risk by normalizing each index's returns to a beta of 1.0, allowing for a cleaner comparison of companies with varying risk profiles.

The results showed a clear and consistent pattern: companies with higher levels of SBC tended to outperform those with lower levels, even after adjusting for risk. These findings point to stock-based compensation as a potentially meaningful factor for investors when evaluating company fundamentals and looking for long-term performance.

Acknowledgements

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Introduction

This thesis measures stock-based compensation (SBC) as a percentage of a company's earnings before interest, taxes, depreciation, and amortization (EBITDA). This metric, EBITDA, represents an approximate value for a firm's cash flow from its operations. Stock-based compensation has become a cornerstone of employee compensation in recent decades, and for good reasons. By issuing shares in the company that employees work for, employee incentives and shareholder incentives become more aligned. This helps foster a culture of long-term thinking and creates a sense of ownership for the employees. The highest form of stock-based compensation is through an ESOP, a unique business structure that offers high ownership rights to long-time employees. Unfortunately for this thesis, these types of companies are privately held and information detailing their financials are not available to the public. Because of this, I have created indices, each containing companies with distinct levels of stock-based compensation. Indices track the overall performance of a collection of companies. If many companies perform well over a given period, the index performs well, and vice versa for poor performance. Using indices, I can more easily compare the broader effects of companies that provide distinct levels of stock-based compensation.

I believe it is important to investigate companies through the lens of stock-based compensation, especially given headlines, such as 'Annual compensation reaches $14.2 million for CEOs as companies grapple with worker shortages and inflation'. This is why stock-based compensation interested me personally, as it is a form of compensation that isn't cash-based but can still provide significant levels of compensation for the employees working for the company.

Research Questions

The questions I have for this thesis come from being an investor in the stock market myself. Since individuals are unable to invest in ESOP, companies which offer prominent levels of employee compensation, the closest alternative is to invest in companies that offer elevated levels of SBC. Looking at investing through this lens will answer several questions. Firstly, should investors care about differing levels of SBC? Secondly, do indices with higher levels of stock-based compensation perform better than companies with lower levels? Do they perform worse? Lastly, I want to examine how the indices perform during economic expansions and contractions. Will there be a noticeable difference between the indices? Do indices with higher levels of SBC perform better than indices with lower levels of SBC? Do they perform worse?

History of Stock-Based Compensation

Stock-based compensation emerged as a corporate tool in the mid-20th century but started to gain traction in the 1980s and 1990s. SBC was initially used as an incentive option for management personnel to align their interests with the interests of shareholders, rather than performance targets like units sold, revenue, or profitability, which can be subject to manipulation. In the 1990s and early 2000s, SBC began to expand beyond C-suites and into broader employee pay packages, especially in the technology sector. SBC was being implemented in the technology sector because many of the tech companies that became publicly available to trade (IPO'd) in the 90's were hardly profitable and had small cash reserves, subsequently, technology companies paid their employees a combination of salary and stock, with the expectation that the company's stock would appreciate. This practice was instrumental in the scaling of companies like Microsoft, Amazon, and Google, all of which weren't profitable

for years and had small cash supplies outside of proceeds from selling more shares or debt financing.

Regulatory change stopped the widespread adoption of SBC due to FAS 123R which was adopted in 2006 by the Financial Accounting Standards Board (FASB), a regulatory board that sets accounting standards for public companies in the United States. This regulation required companies to expense SBC on their income statements even though SBC is a non-cash expense. This made SBC more transparent to investors, and lowered profitability for companies providing SBC to employees.

Regardless, SBC has become a standard part of compensation packages across many different industries, through it remains most prevalent in technology, biotech, and high-growth start-ups.

Literature Review

Free Cash Flow: Its Importance to Companies and Investors and its Relationship to EBITDA

Understanding the importance of free cash flow is essential to understanding the financial world. Free cash flow (FCF) is a fundamental metric for measuring a company's financial health and operational efficiency. It represents the cash a company generates after deducting the costs needed to run the operations of the company as well as any capital expenditure required to maintain or expand the company's asset base, (e.g. investments into property, plant, equipment, or intangible assets such as patents or trademarks). Unlike a corporation's profit, which accounts for non-cash items and one-time gains[1], FCF provides a clear picture of liquidity available for strategic decisions such as paying down debt, reinvesting in the business, or returning value to shareholders via share buybacks and dividends.

Shareholders value FCF because it directly correlates to a company's ability to generate shareholder value. Research also continues to show that companies with strong, consistent free cash flow growth tend to outperform their peers over the long term[2]. Additionally, FCF serves as one of the fundamental instruments in valuing a company. One of the most popular methods of valuing a company is by utilizing a discounted cash flow (DCF) analysis, which projects and discounts future free cash flow generated by a company. It is for these reasons that shareholders value FCF so highly and why companies aim to get this number as high as possible.

For this thesis, EBITDA was used instead of FCF. EBITDA stands for 'Earnings before Interest, Taxes, Depreciation, and Amortization'. In the world of finance, EBITDA is generally

[1] Maksy, M. M. (2013).

[2] Wagner, H. (2024, April 7)

considered to be a proxy for FCF because it omits non-cash expenses, while strongly resembling the core operations of the business before paying cash to debt holders or governments. Furthermore, SBC is expensed from EBITDA, providing a preexisting relationship for the two metrics.

Stock-Based Compensation: A Double-Edged Sword

Since the 1970s, stock-based compensation has emerged as a prevalent form of employee compensation, most notable in technology and other high-growth sectors. The rapid change in CEO compensation packages highlights how far the compensation pendulum has swung. As of the 1970s, about 85 percent of CEO pay was in cash. Today, cash compensation only makes up 25 percent of a CEOs pay[3].

SBC is also a way for companies to align employee incentives with the interests of shareholders by awarding equity or equity-linked instruments as part of compensation packages. This creates an incentive for employees to stay with a company long-term. Research has shown that companies that offer stock generally increase employee retention, as it provides employees with a personal stake in the company's long-term success[4].

Stock-based compensation does not come without its own drawbacks. When stock or equity is awarded to employees, it reduces the ownership percentage of existing shareholders. This dilution, if large enough, can materially affect key valuation metrics, such as earnings per share (EPS), and dampen investor confidence if SBC levels are perceived as excessive relative to free cash flow. This is because excessively high SBC relative to FCF can signal that a company's

[3] Frydman, C., & Jenter, D. (2010)
[4] Rajbhandary, S., & Capwell, J. (2024, February 12)

cash balance is highly uncertain. In addition, research has shown that nearly all the increase in stock-based compensation has replaced cash wages[5].

Index Funds: A Popular Investment Tool

A stock index is a collection of stocks that represent the performance of a specific market, sector, or whichever variable an investor would like to focus on. This allows investors to gauge the overall health of the companies within the index by tracking the price movements of each company and computing a weighted average of each company's movement for the day. In essence, an index acts like a scorecard for the market, with well-known examples being the Dow Jones Industrial Average or the S&P 500.

Index funds today are some of the most popular investment tools available to investors. Wells Fargo created its first index fund in 1971, but the first publicly available index fund was offered by The Vanguard Group in 1976[6]. In 1993, passive index funds comprised less than three percent of all funds on the market, but as of January 1st, 2024, they make up over 53%[7]. Passive funds are funds that are created to mimic the overall performance of the market, rather than trying to outperform the market by actively adjusting which companies are being held. The skyrocketing popularity of index funds is for a good reason; investors in the S&P 500 received average returns of nearly 10% since 1957. In addition, index funds offer diversification, lower risk, and low cost in contrast to the high fees required by actively managed funds, which over long periods of time performed worse than passive funds.

[5] Eisfeldt, A. L., Falato, A., & Xiaolan, M. Z. (2022)
[6] Bob Pisani. (2023, January 23)
[7] Carosa, C. (2024, April 3)

Index fund investing also takes away the individual choice of picking particular companies. This is because, for the most part, retail investors, people who buy and sell securities for their own personal portfolio rather than an institutions, will buy into index funds that cover large swaths of the market. The only choice between two index funds that an average retail investor may consider is a) past performance, b) outlook, c) risk tolerance, and d) personal convictions. An investor may buy into the S&P 500 because it has historically produced the largest returns, or another investor may buy into the Nasdaq composite because they believe in the outlook of the technology sector. In sum, index fund popularity has risen dramatically over the decades because of their easy-to-use format, diversified risk selection, and impressive historical performance[8].

Index funds are a useful investment tool, but investors should be aware of the downsides that come with index investing. To start, because index funds are designed to match the performance of the market, they offer limited potential for outsized returns. If an individual is searching for high returns, an index fund will usually be the wrong tool for the job[9]. To add, index funds must follow a strict set of rules and guidelines. These guidelines, while necessary for the transparency investors are looking for, means these funds cannot quickly adjust holdings in response to market swings. While not immediately a disadvantage during times of growth, a market contraction can cause undesirable volatility thus limiting returns.

[8] Hendricks, M. (2024, August 22)
[9] Hendricks, M. (2024, August 22)

Methods

To compare the correlation between stock-based compensation as a percentage of EBITDA and company share price performance, I constructed 4 indices from a dataset of 52 companies selected from the S&P 500. The indices were constructed in the following manner: Index 1 contains companies whose SBC as a percentage of EBITDA is in the first quartile relative to the entire selection of 52 companies. The second index was constructed in the same manner except it took companies residing in the second quartile. To add, an additional parameter was introduced later in the research process after discovering that companies frequently moved between indices, though they primarily remained in one quartile. To account for this, SBC/EBITDA was smoothed using a 3-year moving average. This adjustment lowered the overall noise from frequent jumps and made the data much more comprehendible. The industries of the companies selected are seen in Figure 1:

Industry	**Count**
Consumer Discretionary	14
Consumer Staples	6
Industrials	10
Information Technology	9
Health Care	5
Financials	3
Materials	1
Communication Services	4
TOTAL	**52**

Figure 1: Total number of primary industry groups from the 52 distinct companies in the dataset

An example showing the importance of the 3-year moving average is seen in Figure 2 with Nvidia. Aside from earlier years, Nvidia's SBC as a percentage of EBITDA consistently hovered in high teens or low 20's, however in 2023 it shot up to 38%. To prevent the impact a

single outlier may have on the analysis outliers, and thus forcing a company to leave its index, the three-year moving average weighs the recent year, as well as the two years prior to it. In addition, the data shows that the spike in the SBC % of EBITDA is due to a) the company utilizing more SBC, thus growing the numerator of the SBC/EBITDA equation, while b) shrinking the denominator, which represents the company's cash flow. So, while the company utilized higher SBC by compensating its employees through shares, it's not as large as the ratio initially presents. Thus, utilizing a 3-year moving average kept Nvidia in the same index for 7 out of the 13 years of analysis, rather than more frequent index hopping.

Nvidia

Date	SP	EBITDA	SBC	SBC % of EBITDA	3 year MA	Mkt Cap
12/31/2023	$49.50	$7,121	$2,709	38.0%	26.6%	$1,223,193
12/31/2022	$14.60	$11,215	$2,004	17.9%	22.7%	$359,651
12/31/2021	$29.36	$5,819	$1,397	24.0%	21.3%	$735,275
12/31/2020	$13.02	$3,227	$844	26.2%	17.1%	$323,242
12/31/2019	$5.86	$4,066	$557	13.7%	12.3%	$144,004
12/31/2018	$3.31	$3,409	$391	11.5%	14.0%	$81,435
12/31/2017	$4.78	$2,124	$247	11.6%	15.6%	$117,261
12/31/2016	$2.63	$1,075	$204	19.0%	17.9%	$57,533
12/31/2015	$0.80	$979	$158	16.1%	16.7%	$17,732
12/31/2014	$0.48	$735	$136	18.5%	16.7%	$10,898
12/31/2013	$0.38	$878	$137	15.6%	18.9%	$9,108
12/31/2012	$0.28	$853	$136	16.0%	47.7%	$7,661
12/31/2011	$0.32	$398	$100	25.2%	80.8%	$8,464
12/31/2010	$0.35	$238	$243	102.0%	77.0%	$8,947
12/31/2009	$0.43	$141	$163	115.2%		
12/31/2008	$0.19	$970	$133	13.8%		

Figure 2: Nvidia financial information, all $ are in millions of dollars

The process for acquiring financial information for each company was through two primary sources. The first was through the official website of the Securities and Exchange

Commission (SEC), a U.S. government agency that enforces federal securities laws and regulates the securities industry to protect investors and maintain fair, orderly markets. The second method was by using Standard & Poor's Capital IQ. This tool is commonplace among financial and accounting firms for quickly retrieving company financial information without having to directly search for the desired data in a company's public financial information. This was my preferred method, but I also verified that the information retrieved was accurate by comparing it to the company's public financial statements through the SEC's website.

The quartiles that set the parameters for each index are seen in Figure 3. The placement of the number of each quartile represents the upper bound of each quartile. For example, in 2023, the upper bound of the 1st quartile was an SBC % of EBTIDA of 19.49%. The first quartile contains data points that are in the bottom 25% of a dataset, and the fourth quartile contains the data points that are in the highest 25% of a dataset.

Lower Bounds of Each Quartile

Year	Q1	Q2	Q3	Q4	Max
2023	6.87%	19.49%	27.82%	45.50%	121.68%
2022	5.99%	22.37%	27.20%	48.80%	99.32%
2021	5.31%	17.21%	26.77%	47.00%	97.13%
2020	4.73%	17.31%	26.63%	42.12%	98.56%
2019	4.28%	17.44%	26.62%	44.27%	3927.18%
2018	3.85%	16.60%	26.07%	40.70%	3943.89%
2017	3.39%	17.28%	26.94%	44.52%	3951.69%
2016	2.82%	17.76%	30.10%	46.00%	174.75%
2015	2.26%	18.27%	31.59%	47.86%	197.83%
2014	1.75%	18.73%	32.42%	55.93%	376.76%
2013	1.33%	18.94%	31.81%	58.75%	525.32%
2012	0.99%	17.70%	32.98%	52.28%	526.26%
2011	0.77%	14.35%	29.44%	44.47%	549.70%
2010	0.63%	17.86%	32.01%	47.28%	144.14%

Figure 3: Quartile upper and lower bounds based on a 3-year moving average. The max column is the upper bound of the 4th quartile.

The first year that each index starts is in 2010, while the financial data for each firm goes back to 2008. This was done to observe how companies award stock-based compensation during bust cycles, most notably during the financial crisis and the years immediately after.

To measure the performance of the indices, I chose to allocate the entire market capitalization of a company to its index. For example, in 2010, Index 1 is the sum of all the market capitalizations of companies whose SBC % of EBITDA is within the first quartile. However, doing this for each index will provide different starting sums. To directly compare each index, I assigned each index an identical starting value. This was done with a divisor and the calculations for this are shown in Figure 4. The divisor was also changed every year to adjust the overall index value as companies left or joined the index over time. Otherwise, if a company leaves the index, and a company with a different market capitalization joins the index, the value of the index will either rise or fall, depending on if the capitalization of the and departing.

Divisor 12/31	Divisor 1/1	Index 1	Date	Index 1 Value
5.79	NA	788,733	12/31/2023	4,567,526
5.89	5.79	550,828	12/31/2022	3,243,189
7.22	5.89	748,755	12/31/2021	5,405,843
7.09	7.22	571,510	12/31/2020	4,053,888
7.71	7.09	364,636	12/31/2019	2,812,279
5.68	7.71	240,268	12/31/2018	1,364,465
6.23	5.68	261,025	12/31/2017	1,625,318
6.84	6.23	194,700	12/31/2016	1,331,560
6.25	6.84	192,967	12/31/2015	1,206,133
7.99	6.25	195,763	12/31/2014	1,564,134
7.32	7.99	174,503	12/31/2013	1,277,583
7.07	7.32	143,856	12/31/2012	1,017,509
7.63	7.07	118,548	12/31/2011	904,301
7.99	7.63	100,000	12/31/2010	799,059

Figure 4: Index 1 raw value and divisor adjusted value over time. Value is kept in points // Higher points = higher returns from the index

This was done for each index, and their values are listed below in Figure 5.

Market Capitalization Weight

Date	Index 1 Value	Index 2 Value	Index 3 Value	Index 4 Value
12/31/2023	**788,733**	**813,085**	**592,247**	**572,469**
12/31/2022	550,828	433,140	417,274	429,601
12/31/2021	748,755	816,766	555,374	534,450
12/31/2020	571,510	614,493	408,358	467,819
12/31/2019	364,636	436,015	345,413	306,622
12/31/2018	240,268	340,004	290,290	225,903
12/31/2017	261,025	341,544	318,918	234,949
12/31/2016	194,700	243,647	273,881	193,800
12/31/2015	192,967	221,542	256,345	195,625
12/31/2014	195,763	168,509	244,882	189,539
12/31/2013	174,503	151,066	232,433	136,645
12/31/2012	143,856	111,440	151,700	99,932
12/31/2011	118,548	103,886	100,038	92,072
12/31/2010	**100,000**	**100,000**	**100,000**	**100,000**

Figure 5: Each index analyzed over time, starting value of 100,000

The values shown in Figure 5 were all traditional market-capitalization weighted indices. Analyzing the differences reflects the impact of SBC on total market performance or investor response. In a market-cap weighted index, larger firms will naturally dominate overall performance due to a heavier weighting applied to them. Using a market-cap weighted index provides a good lens when looking at overall shareholder impact, portfolio implications, or economic footprint, however it also may skew results for this analysis. Figure 6 shows the performance of indices that use the equal-weighting method, meaning each company will contribute to the overall performance of the index equally, regardless of size. This is best used when solely studying the effect of SBC levels across all companies. Since I'm analyzing how SBC levels differ against each other, I am only going to be using and analyzing the equally weighted indices. To provide equal weight and measure return, the following formula was used:

$$\text{Index Return} = \frac{1}{N}\sum_{i=1}^{N}\text{Return}_i$$

Equal Weight Index

Date	Index 1	Index 2	Index 3	Index 4
12/31/2023	**928,464**	**994,238**	**855,407**	**1,181,002**
12/31/2022	687,141	723,117	668,667	963,307
12/31/2021	865,504	855,431	820,607	1,097,663
12/31/2020	629,403	593,684	626,148	943,883
12/31/2019	433,372	457,985	509,225	558,039
12/31/2018	314,879	365,898	351,842	390,348
12/31/2017	207,847	372,794	402,104	428,708
12/31/2016	155,850	289,190	282,796	335,631
12/31/2015	158,119	202,854	204,126	316,952
12/31/2014	165,194	167,560	183,621	285,999
12/31/2013	149,103	155,998	170,755	224,326
12/31/2012	110,898	115,323	104,120	125,436
12/31/2011	105,483	110,539	90,622	102,145
12/31/2010	**100,000**	**100,000**	**100,000**	**100,000**

Figure 6: Index Performances, Equal Weight

Date	Index 1	Index 2	Index 3	Index 4
12/31/2023	**29.68%**	**37.62%**	**29.19%**	**23.65%**
12/31/2022	-17.94%	-15.89%	-24.00%	-11.27%
12/31/2021	34.78%	47.15%	29.99%	13.13%
12/31/2020	41.10%	28.62%	24.45%	77.91%
12/31/2019	37.66%	21.17%	50.11%	47.32%
12/31/2018	45.83%	-1.83%	-11.81%	-6.74%
12/31/2017	35.19%	24.52%	48.96%	19.67%
12/31/2016	-1.34%	44.87%	44.54%	4.83%
12/31/2015	-5.16%	21.32%	10.84%	8.19%
12/31/2014	11.66%	7.29%	8.95%	21.70%
12/31/2013	33.61%	28.16%	65.91%	65.96%
12/31/2012	4.65%	4.05%	16.85%	19.17%
12/31/2011	4.51%	10.37%	-12.64%	2.24%
12/31/2010	NA	NA	NA	NA
Average Beta	**1.06**	**1.03**	**0.93**	**1.14**

Figure 7: Beta Adjusted Returns

An additional parameter was included to adjust for the different betas of the indices. Beta is a measure of systemic risk within the market, that is, how volatile the company is compared to the greater market. For example, a company with a beta of 1.1 will, on average, move 1.1% for each 1% move the market makes – positive or negative. By adjusting each index to a beta of 1, I can see the risk-adjusted returns of each index. This is important to measure because companies high in SBC typically have higher betas, so adjusting for different betas produces more comparable data to analyze.

Results and Discussion

After completing the construction of the indices, I was able to graphically compare the performances of each index. The performance of each index, measured against each other, is shown in Figure 8.

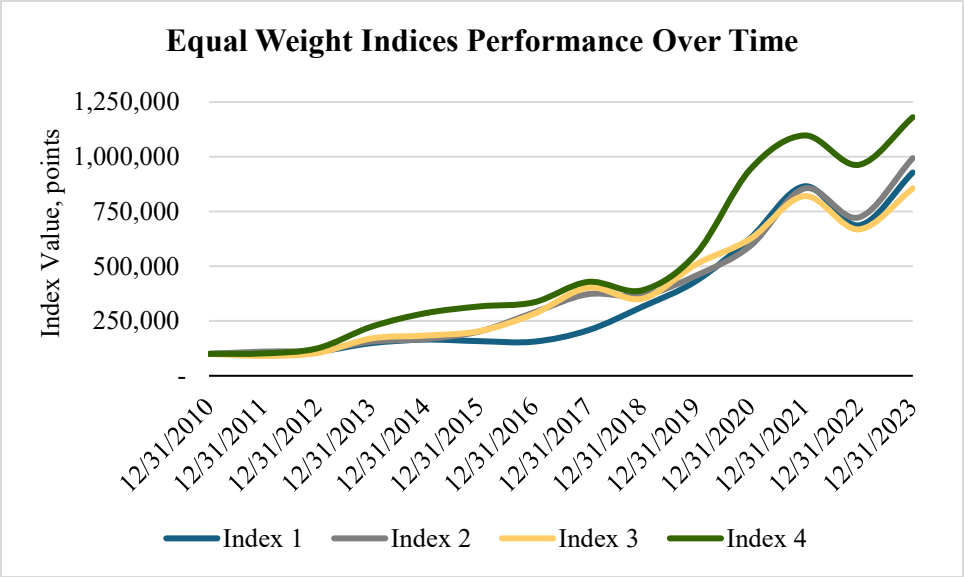

Figure 8: Equal Weight Index Performances Over Time

The next graph, Figure 9, demonstrates the importance of risk adjusted returns for indices.

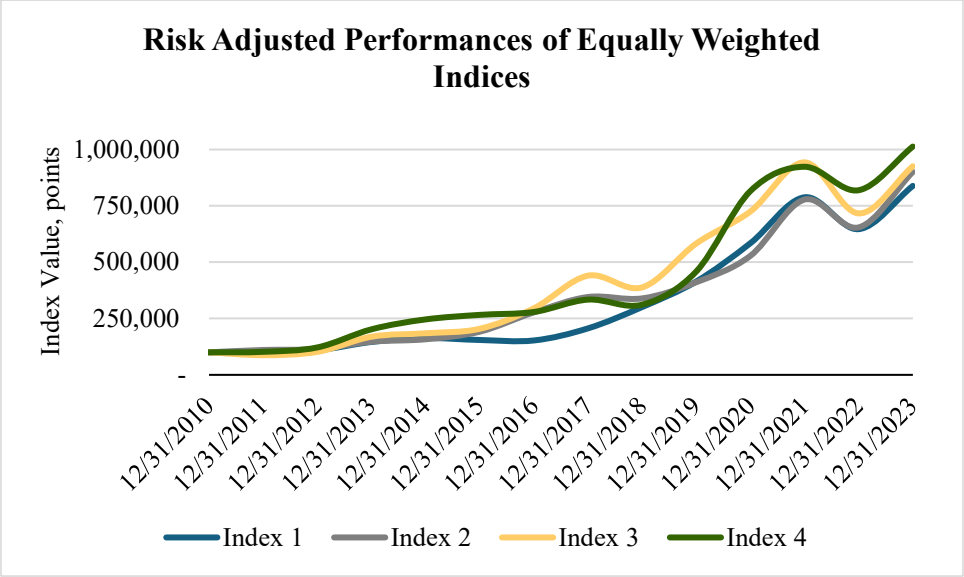

Figure 9: Risk adjusted index performances

The difference between the risk adjusted returns and the non-risk adjusted returns is stark. Index 4, the index with the highest levels of SBC as well as the highest average beta, had a risk adjusted value that was nearly 15% lower than the non-risk adjusted index, while Index 3, which had the lowest beta, had a risk adjusted returns value that was nearly 9% higher than the non-risk adjusted returns. Additionally, it appears that the performance of the indices followed a descending order such that the indices with higher levels of SBC performed better over the years of 2010-2023 than indices with lower levels of SBC. Index 3 had the lowest beta (Figure 7), as it is typical for companies higher in SBC to be younger, and more volatile compared to the market.

Not all industries are made equal. Throughout the 2010s and early 2020's certain industries performed better than others. Because of this, it was important to analyze the different industry make-ups within each index. I was able to identify eight primary industry groups within the dataset from the listed companies. These industries were: Consumer Discretionary, Consumer Staples, Industrials, Information Technology, Health Care, Financials, Materials, and Communication Services. The breakdown of the total number of each industry within the dataset, as well as the breakdown of what each index is comprised of is seen in figures 1,10-13.

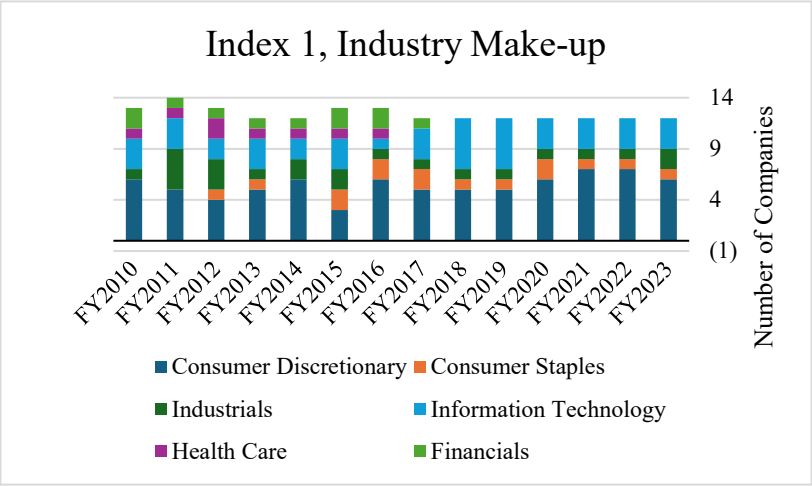

Figure 11: Index 1 Industry Make-up

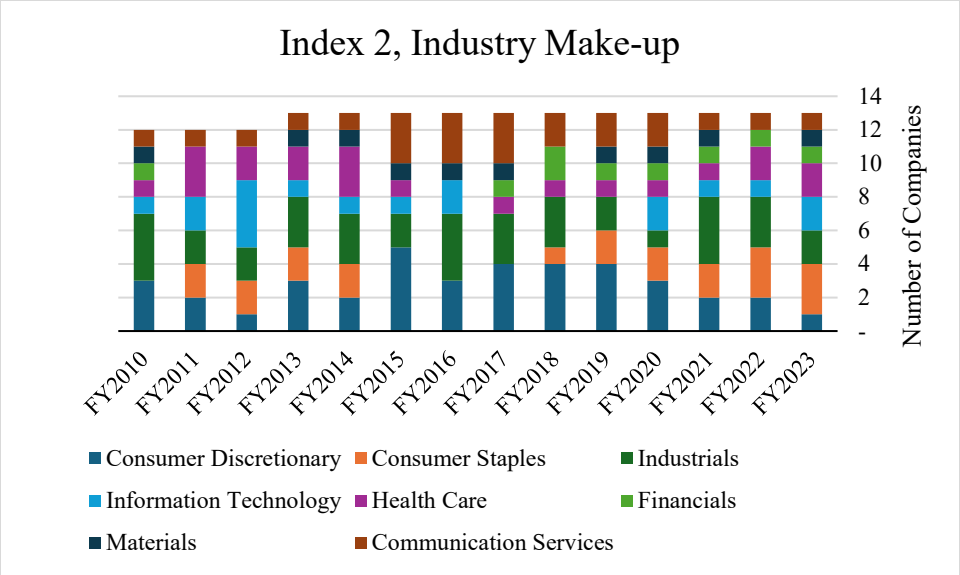

Figure 12: Index 2 Industry Make-up

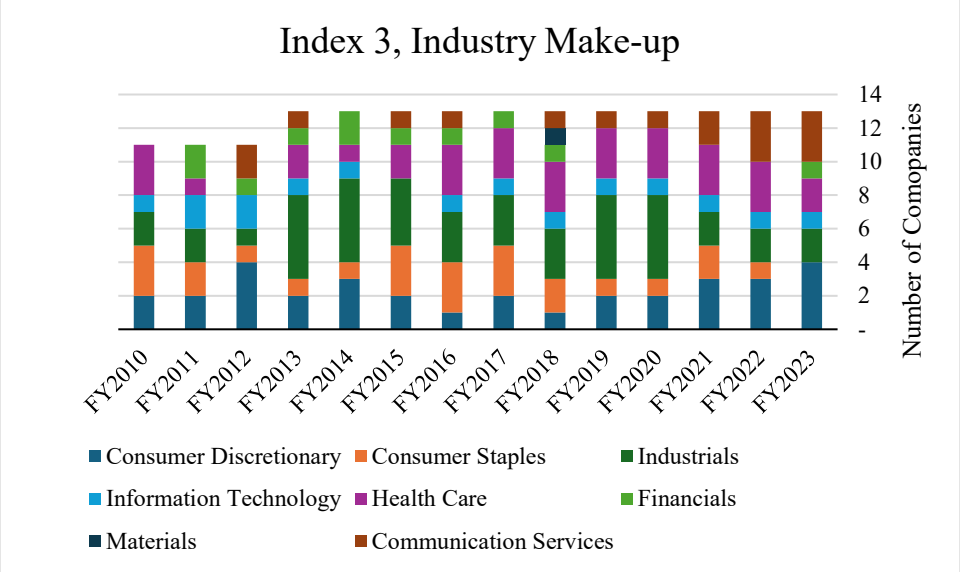

Figure 13: Index 3, Industry Make-up

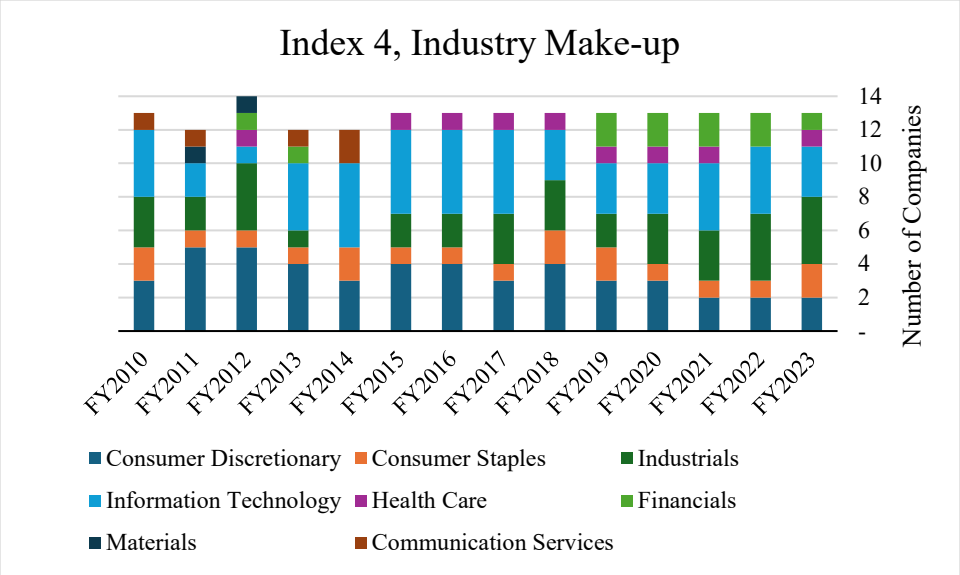

Figure 14: Index 4, Industry Make-up

Examining the industry make up of each index, it appears that Index 1 is largely comprised of Consumer Discretionary stocks, Index's 2 and 3 have a seemingly equal blend of industries, and Index 4 is historically mainly comprised of Information Technology companies.

An additional metric to examine the indices under is their interest coverage ratios (ICR). An interest coverage ratio follows the formula EBIT/Interest Expense. This ratio represents how effectively a company can cover its debt obligations while remaining financially solvent. It is important for companies to have an interest coverage ratio that is greater than 1.0x, as an ICR less than one could lead a company to default on its debt. Figure 15 shows how the median ICR changed over time for the dataset. The lowest ICR value was during the Covid-19 pandemic from February to April of 2020.

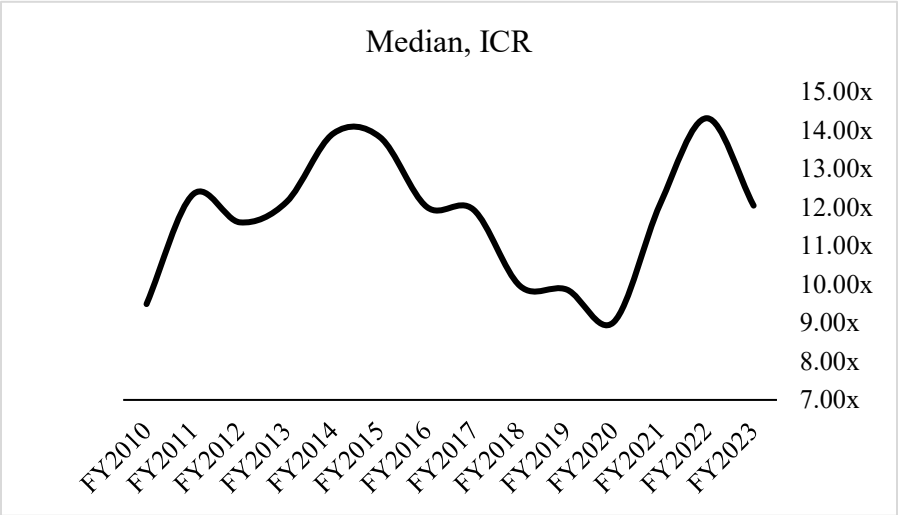

Figure 15: Median ICR of companies within the 52-company dataset

Index analysis from 2010-2016

The period from 2010 to 2018 was a unique environment for the stock market. This was the period directly following the financial crisis. To stimulate the economy and promote investment, the Federal Reserve (FED), kept interest rates below 0.50% for over six years. During this recovery period, the data suggests that companies with the highest levels of stock-based compensation performed the best, and the companies with the lowest performed the worst, although they still garnered strong positive returns.

Other than the intense bull market run and ultra-low interest rates, the U.S market was able to remain resilient among international headwinds such as the European debt crisis, China's economic slowdown, and Brexit. Additionally, important regulations in 2010 like the Dodd-Frank Act increased transparency and accountability in the financial system, strengthening investor confidence and encouraging investment in the markets.

Additionally, during the 2010-2016 period SBC was at its highest levels for the entire 13-year period as seen in Figure 16. These elevated levels of SBC suggest that companies were trying to attract and retain talent in the expansionary post-financial crisis environment.

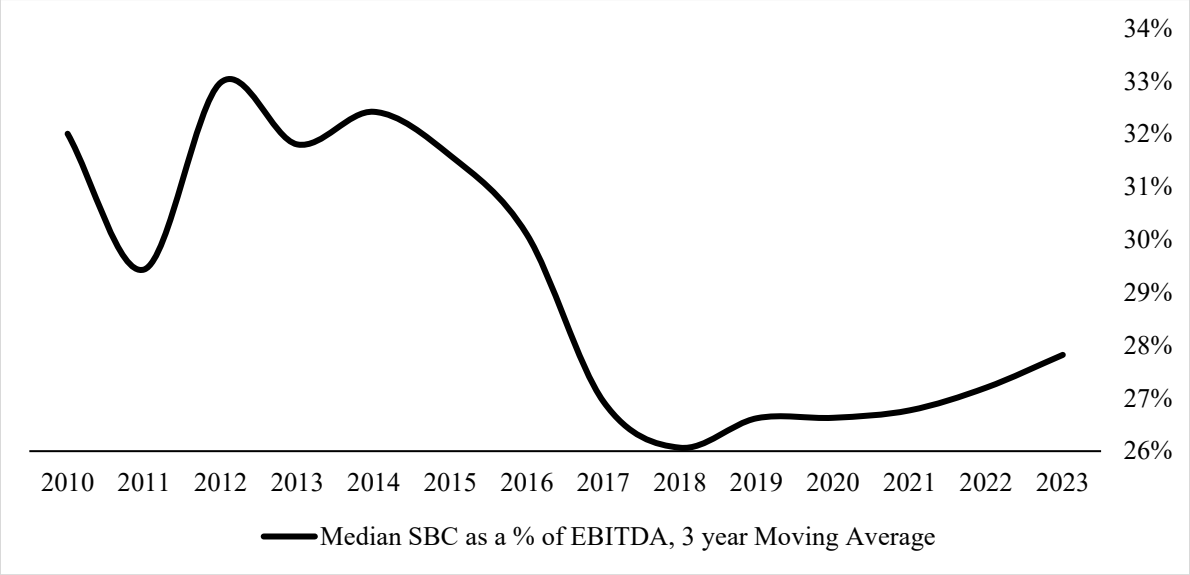

Figure 16: Median SBC as a % of EBITDA, 3 year – Moving Average

Index analysis from 2016-2020

The period from 2016-2020 was the only period where Index 4 didn't have the highest cumulative returns, rather it was indices 2 and 3 that performed the best. This period was also the first time in eight years that the Federal Reserve raised interest rates above 1% starting with a 50-basis point increase in 2016, followed by seven additional rate hikes until the Covid-19 pandemic. It is likely that the companies with the highest levels of SBC saw a decrease in growth due to cash flow constraints, which limited the number of shares firms could repurchase to offset the dilutionary effects of issuing shares through stock-based compensation. This is visually depicted in Figure 17. This is where the double-edged sword effect of issuing significant

quantities of stock through SBC begins to show its downsides. While it is an effective tool in retaining employees and creating a shared vision between the employees, management, and outside investors, it becomes a burden during times when cash is more constrained, and companies are unable to repurchase at the same rate of issuance. When this happens, a company's stock becomes diluted, negatively affecting the attractiveness of the company for investors.

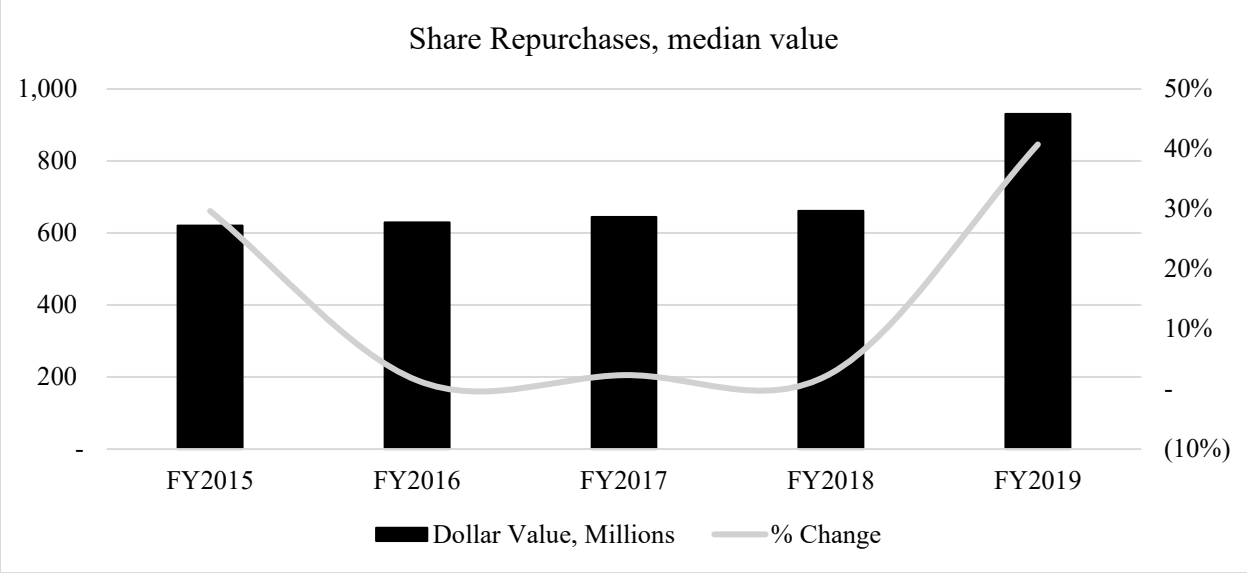

Figure 17: Dollar Value of median share repurchases

To add, every index other than Index 4, which had the highest levels of SBC saw strong gains in performance. It wasn't until 2019, when median share repurchases increased, that Index 4 reclaimed its spot at the top relative to the other three indices.

Index analysis from 2020 to 2023

The period from 2020 to 2023 is the most important period to analyze during the entire timeframe. This is because it is the only recessionary period, the period with the highest interest rates, unemployment, and inflation. In other words, this is the period where the market outlook was most uncertain, and the strengths and weaknesses of each index are identified.

To begin, this is the period where the indices categorize themselves into the descending order of performance and stock-based compensation, in other words Index 4 placed first, Index 3 placed second, Index 2 placed third, and Index 1 placed last. This order reflects the benefits of being committed to attracting top talent, aligning interests between employees and management, fostering a culture of ownership, and conserving cash. These qualitative and quantitative benefits of higher SBC allowed Index 4 to be best positioned for the post Covid-19 recovery period, which saw some of the highest levels of investment in history due to record low inflation and interest rates. This appears to agree with the literature surrounding high SBC firms, in that these companies are more resilient during times of crises and perform better in the years following because of this resilience. For example, during the market-wide turmoil of 2022 due to rising inflation and interest rates (Figure 18), Index 4 lost only 11% of its value, while the average loss of the other indices was 19%.

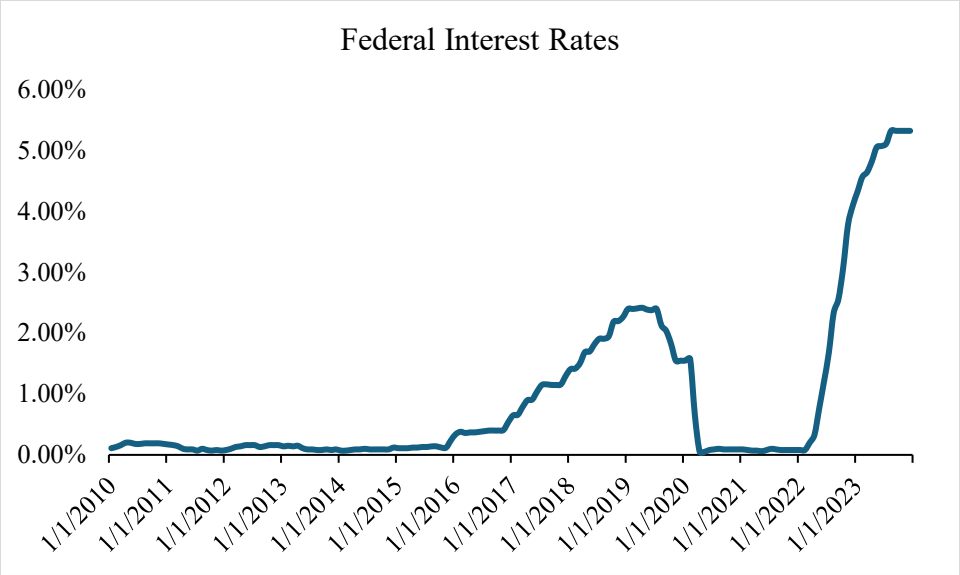

Figure 18: Federal Interest Rates

Conclusion

This thesis investigates whether there is a difference between company market performance through the lens of stock-based compensation. The data gathered and analyzed is helpful for investors who are interested in investing in companies that invest in their employees. That is, companies that incentivize their employees with long-term goal orientation, strong capabilities to retain talent, and high adaptability through cash conservation.

When comparing index performance containing companies with distinct levels of SBC, the data suggests that companies with the highest levels of stock-based compensation outperformed their peers, even on a risk adjusted basis using beta. This outperformance was cumulative over the years from 2010 to 2023. However, it is worth noting that for the years 2016-2019, a period with interest rate hikes and the U.S. – China trade war (2018-2019), companies with elevated levels of SBC couldn't repurchase the shares issued to offset the dilutionary effect provided by large issuances of stock. This discouraged investment and led to Index 4 losing its position as the highest performer among its peers. Index 4 didn't reclaim its position for 3 years, when companies began repurchasing shares at an increased rate, reducing the dilutionary effects produced by large share issuances.

In conclusion, the data shows that from 2010 to 2023, companies with higher levels of stock-based compensation tended to outperform, suggesting that this metric may be a useful indicator for identifying strong-performing firms. While other factors certainly contributed to how the stock market performed as a whole, the consistency of the results make a compelling case for including stock-based compensation as a consideration in investment analysis.

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